

AMERICAN MUSEUM *Novitates*

PUBLISHED BY THE AMERICAN MUSEUM OF NATURAL HISTORY
CENTRAL PARK WEST AT 79TH STREET, NEW YORK, N.Y. 10024
Number 2809, pp. 1–18, figs. 1–38 February 19, 1985

The *Eupithecia* (Lepidoptera, Geometridae) of Mississippi and Louisiana

FREDERICK H. RINDGE¹

ABSTRACT

Seven species of *Eupithecia* (Larentiinae) are found in the states of Mississippi and Louisiana. One of these, occurring throughout the southeastern United States, has been misidentified as *herefordaria*; it is described as *E. matheri*, new species (type locality: Vicksburg, Mississippi). The true *herefordaria* Cassino and Swett is redescribed; it is found only in southeastern Arizona. Two other new species are described: *E. vicksburgi* (type locality: Vicksburg, Mississippi) and *E. broui* (type

locality: Weyanoke, Louisiana). The other taxa found in these two states are *E. peckorum* Heitzman and Enns (reported for the first time from both states and eastern Texas), *miserulata* Grote, *jejunata* McDunnough, and *swettii* Grossbeck. Diagnostic notes are given for *exudata* Pearsall, from the Middle Atlantic states, to distinguish it from *matheri* and *jejunata*. All species are described; the adults and genitalia are illustrated.

INTRODUCTION

The genus *Eupithecia* occurs throughout much of the world and contains a very large number of species; these are often difficult to identify, as the moths are small, usually grayish, and have basically similar maculation. The genitalic organs of both sexes, however, usually have good specific characters and therefore play an important part in the taxonomy of the genus. For a good part of the world it is very difficult to make accurate determinations, due to an almost complete lack of descriptions and illustrations of the

genitalia. Fortunately, we do not have this problem in North America, north of Mexico, as McDunnough published a revision for the 145 species known in 1949. Since then a few new species have been described and a few name changes have been made, but basically McDunnough's revision still stands as it was published—a monumental work. However, this does not mean that the last word has been said about the North American fauna as there are still many areas on the continent that have been poorly collected or not collected at all,

¹ Curator, Department of Entomology, American Museum of Natural History.

and collecting needs to be done during all seasons of the year. One of these poorly known areas is the western gulf states of Mississippi and Louisiana; when McDunnough published his revision, he had practically no specimens of *Eupithecia* to study from those states. Since then a great deal of collecting has been done there, and the present paper reports on the members of this genus from those two states.

Bryant Mather has been collecting *Eupithecia* in Mississippi (among a great number of other Lepidoptera) since late 1958. Other specimens in his collection were caught by M. and E. Roshore, M. Glass, R. and B. Taylor, C. Bryson, and R. Kergosien. Additional specimens came from the Agricultural College collection (now Mississippi State University), with Benjamin, Henderson, and Spinks having collected the moths in 1920 and 1921. The American Museum has some material from Camp Shelby, near Hattiesburg, Mississippi, collected in 1944 by C. Michener. All this material added up to approximately 1200 specimens, a rather remarkable total for *Eupithecia* from a single state. With the exception of the Michener specimens, all the above moths were sent to me for identification; the majority of them are now in the Museum's collection, having been donated by Mather. Over the years of doing identification work it became obvious that some of the Mississippi material included undescribed species, and that the name applied to another species was of questionable validity.

To make the paper more comprehensive the question of including members of this genus from Louisiana was explored. Vernon A. Brou was agreeable to this, and his generous cooperation made it possible to study material from that state. Brou had previously deposited some of his specimens in the American Museum, whereas others came to us through Mather; Brou generously lent us all the *Eupithecia* from Louisiana that were available in his private collection.

I did not know that Blanchard and Knudson had begun work on a paper of the *Eupithecia* of Texas before I started the present work. They kindly sent me a list of the five species they have collected in eastern Texas; this information has been included in the

present paper. I have examined only one of their species.

In the above states, one species is both common and widespread, and is the only one to fly every month of the year; this is *miserrulata*, and it is the easiest species to recognize. With the exception of a very few specimens, all the remaining moths of this genus fly only in the spring months and it is with them that difficulties with identification are encountered.

Seven species are known from Mississippi and Louisiana. Three of these are described as new in this paper; another is a widely ranging species in the southeastern United States that was heretofore improperly identified. *Eupithecia herefordaria* Cassino and Swett was the name used by McDunnough (1949) for this last species; a study of the holotype showed that it is known only from southeastern Arizona. Also included in this paper are Mississippi and Louisiana records for *peckorum* Heitzman and Enns, plus the fact that it occurs in eastern Texas; these are the first records of this species outside of Missouri. Several other species, poorly represented in collections when McDunnough published his revision of the genus (1949), have proved to be relatively common and widespread when collectors look for them in the early spring months. An example of this is *jejunata*, which McDunnough described in 1949 from two female specimens; for the present paper I have studied over 300 specimens of it from seven states.

All the genitalic drawings were made at the same magnification and have had the same amount of reduction. Separate ventral and dorsal views have been made of each bursa copulatrix so that the differences between the two sides can be shown. Having separate drawings should avoid some possible confusion that arises from the McDunnough revision (1949), where only one view was provided and the captions have to be consulted to ascertain which one.

ACKNOWLEDGMENTS AND ABBREVIATIONS

I am most grateful to Dr. Bryant Mather of Clinton, Mississippi, Mr. Vernon A. Brou of Edgard, Louisiana, Dr. Edward C. Knud-

son of Bellaire, Texas, and Mr. André Blanchard of Houston, Texas for the specimens and records included in this paper. Mr. Scott Miller arranged for the loan of the holotype and its genitalia of *Eupithecia herefordaria* from the collection of the Museum of Comparative Zoology (MCZ), Harvard University. Practically all the specimens and genitalia illustrated in the present work are from the collection of the American Museum of Natural History (AMNH).

SYSTEMATIC DESCRIPTIONS

Eupithecia peckorum Heitzman and Enns

Figures 1, 2, 13, 14, 31

Eupithecia palpata: Heitzman (not Packard), 1973, p. 172 (misidentification).

Eupithecia peckorum Heitzman and Enns, 1977, p. 77, pl. I, figs. 1–3 (male genitalia, ventral plate), pl. II, figs. 7 (female genitalia), 9 (holotype), 10 (allotype); "1978" [1980], p. 162.

This brown species has very long, flattened palpi that extend beyond the eye 1.4 (male) to 1.5 (female) times the diameter of the eye. The male antennae are shortly bifasciculate, the segments slightly longer than wide, with lateral groups of setae arising ventrally from the two ridges on the ventral surface of each segment, with the setae being about one-half the length of the segment. The female antennae are shortly ciliate below, with a longer pair of setae near the end of each segment.

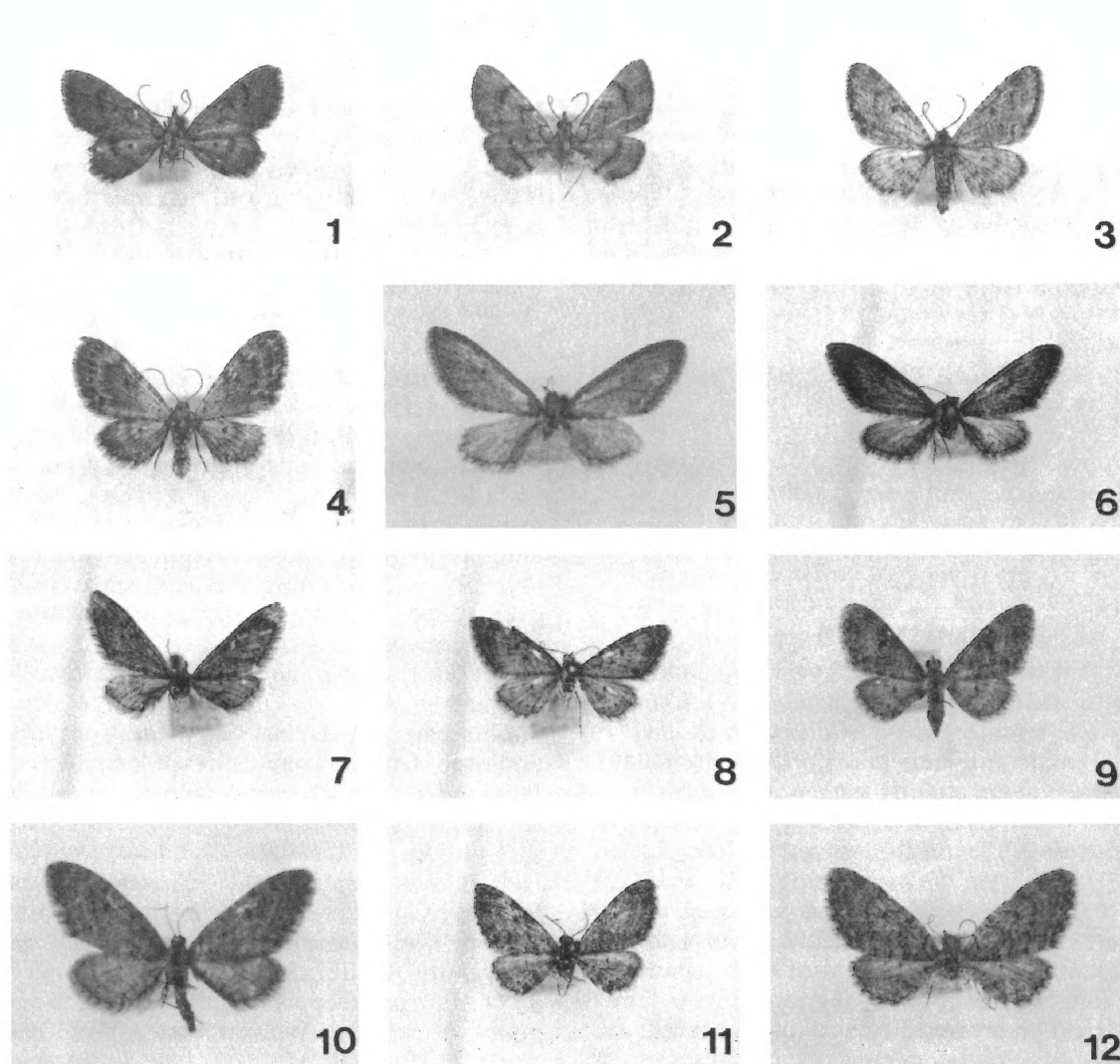
The upper surface of the forewings is faintly reddish brown; the basal line is curved, the t. a. line angled below the costa and then becoming indistinct, the discal dash is elongate, while the t. p. line is the most prominent part of the maculation, being more strongly represented on the upper portion of the wing; there may be a series of small s. t. dots and a larger spot above the outer angle. The hind wings have the anterior portion grayish, changing to brown posteriorly; the maculation consists of a discal spot and a broad extradiscal line. The under surface of all wings is grayish, with black discal dots and broad, prominent black outer cross lines on all wings. The length of the forewing ranges from 8.3 to 9.2 mm.

The ventral plate (fig. 13) consists of two heavily sclerotized, slender, curved arms approaching each other distally, with their apices

angled, then weakly concave with rounded tips. The male genitalia have a long slender uncus with a single prominent apical point; the anellus is flatly elliptical with a short neck connecting broad, curved posterior arms; the valves are very long and slender; the aedeagus (fig. 14) is weakly curved; the vesica has a broad sclerotized piece on the left side one-half the length of the aedeagus, basally with a curved corneous area, and with a second shorter sclerotized piece on the right, becoming rather poorly defined distally. The female genitalia have the bursa copulatrix (fig. 31) that is typical of the *palpata* group (McDunnough, 1949, p. 546), with an elongate, slender, membranous posterior portion having a small rounded sac on the left side about midway; the ductus seminalis arises dorso-laterally on the right side anteriorly and curves caudally; the rounded anterior portion is evenly and densely set with inwardly projecting spines.

The early stages and food plant are unknown.

This species was described from two males and one female caught in Independence, Jackson Co., Missouri, in mid-April. Another specimen was taken in the fall in Jasper Co., Missouri (no additional details were given; Heitzman and Enns, "1978" [1980], p. 162). Four specimens are known to me from Mississippi: The male is labeled Mississippi State University, Oktibbeha Co., March 1, 1976 (C. T. Bryson) (see fig. 1), and the three females, Vicksburg, Warren Co., March 19–April 2, 1984 (B. Mather). One additional male is labeled 4.2 mi NE Abita Springs, St. Tammany Parish, Louisiana, October 6, 1983 (V. A. Brou, at UV) (see fig. 2). Three of the above moths are in the AMNH, and have had their genitalia dissected and mounted on slides. While Heitzman and Enns (see above) reported a specimen taken in the fall, the Louisiana male is the first one to be recorded with full data. This male is smaller than the March and April specimens from Mississippi (8.3 mm forewing length, compared with 9.0 to 9.5 mm, respectively), appears to have the upper surface slightly paler and redder, has more strongly defined cross lines, and the discal dots are obsolescent. This species has also been caught in eastern Texas by Blanchard and Knudson (Knudson, in letter).



FIGS. 1-12. Adults of *Eupithecia*. 1, 2. *E. peckorum* Heitzman and Enns, males. 1. Mississippi State University, Mississippi, March 1, 1976 (C. T. Bryson). 2. 4.2 mi. NE Abita Springs, Louisiana, October 6, 1983 (V. A. Brou). 3, 4. *E. miserulata miserulata* Grote. 3. Male, Vicksburg, Mississippi, January 18, 1980 (B. Mather). 4. Female, Bovina, Mississippi, February 13, 1973 (B. Mather). 5, 6. *E. herefordaria* Cassino and Swett, males. 5. Holotype, Hereford, Arizona, May (MCZ). 6. Carr Canyon, Huchauca Mts., Arizona, March 12, 1977 (R. Wielgus). 7. *E. matheri*, new species, holotype, male, Vicksburg, Mississippi, February 23, 1983 (B. Mather). 8. *E. exudata* Pearsall, male, Chancellorsville, Virginia, April 6, 1972 (F. and P. Rindge). 9. *E. jejuna* McDunnough, male, 4.2 mi NE Abita Springs, Louisiana, February 21, 1983 (V. A. Brou). 10. *E. swettii* Grossbeck, male, Vicksburg, Mississippi, February 25, 1982 (B. Mather). 11. *E. vicksburgi*, new species, holotype, male, Vicksburg, Mississippi, March 26, 1981 (B. Mather). 12. *E. broui*, new species, allotype, female, Weyanoke, Louisiana, February 19, 1982 (V. A. Brou). All in AMNH except as noted. Figs. 1-4, $\times 1.6$; figs. 5-12, $\times 1.8$.

Eupithecia miserulata Grote

Figures 3, 4, 15, 16, 32

Eupithecia miserulata Grote, 1863, p. 32, pl. 2, fig. 4. Heitzman and Enns, "1978" [1979], p.

59, fig. 31 (adult); "1978" [1980], p. 157, figs. 20-22 (male genitalia, ventral plate).

Eupithecia miserulata miserulata: McDunnough, 1949, p. 561, pl. 26, figs. 29-31 (adults), text

fig. 4A (valve, aedeagus, ventral plate, bursa copulatrix) (full bibliography, synonymy, description).

This grayish brown species has very long palpi that extend beyond the eye a distance equal to (male) or 1.5 times (female) the diameter of the eye. The distinctive male antennae have segments that are swollen distad of their bases, and have three pairs of finely ciliate setae, the most anterior pair being nearest the midline, the central pair on the lateral lobes, the posterior pair intermediate in spacing as compared with the other two, and there is a very long seta arising laterally from near the base of each central pair; the three pairs of setae are ciliate, with the latter being somewhat fanlike, and the combined lengths of the cilia and setae are about 1.5 times the length of each segment. The female antennae have a few short cilia on each elongate segment plus a pair of longer setae, presumably corresponding to the very long setae near the middle pair of setae in the males.

The upper surface of the forewings is grayish to grayish brown; the pattern is usually indistinct except for the prominent discal dot, with the subterminal area varying from being concolorous with the wing to light gray or orange (in early spring specimens), and with a faint darkened spot above the outer angle. The hind wings are concolorous with the forewings, and have a small discal spot and a variably represented extradiscal line. The under surface is basically similar to the upper, but with a greater degree of variation, as the maculation varies from faint to very prominent. The length of the forewings ranges from 7 to 10 mm in Mississippi specimens.

The asymmetrical ventral plate (fig. 15) is as distinctive as the male antennae, and consists of two broad, irregularly shaped arms, the left one terminating in a broad recurved apex, and the right side being longer and rounded apically. The male genitalia have a moderately long uncus with a single prominent apical point, the anellus is broad, slightly curved, with a prominent neck leading to the slender, curved posterior arms; the valves are long and slender; the saccus is very deeply invaginated medially; the slender aedeagus (fig. 16) has the vesica with some curved sclerotized pieces anteriorly and a single

elongate rod distally. The female genitalia have the posterior portion of the bursa copulatrix (fig. 32) smoothly sclerotized, with a slightly diagonal spinose ridge, a small sac on the left side, the right extending anteriorly and being recurved, terminating in the ductus seminalis, and with the anteroventral portion swollen and weakly stellate.

The early stages have been known and described for about a century. Recently photographs of the eggs have been published by Peterson (1968, p. 87, fig. 11; not sharply focused and without much detail) and Salkeld (1983, p. 240, fig. 118a-d; scanning electron microscope photographs). The larvae are general feeders on herbs, shrubs, and deciduous trees.

The nominate subspecies occurs throughout most of eastern North America, from Ontario and Maine in the north to Florida, Mississippi, Louisiana, and Texas in the south; it also occurs in Arizona and California with the California population being called *miserulata zela* Swett and Cassino. It is the commonest *Eupithecia* caught in Mississippi and Louisiana, and it is the only species from those states to have been taken in every month of the year. I have before me 195 males and 450 females from Mississippi, and 85 males and 245 females from Louisiana; all these specimens have been spread, and these totals do not include pinned material. The ratio of males to females is 1 to 2.3 in Mississippi, and 1 to 2.9 in Louisiana in the above samples.

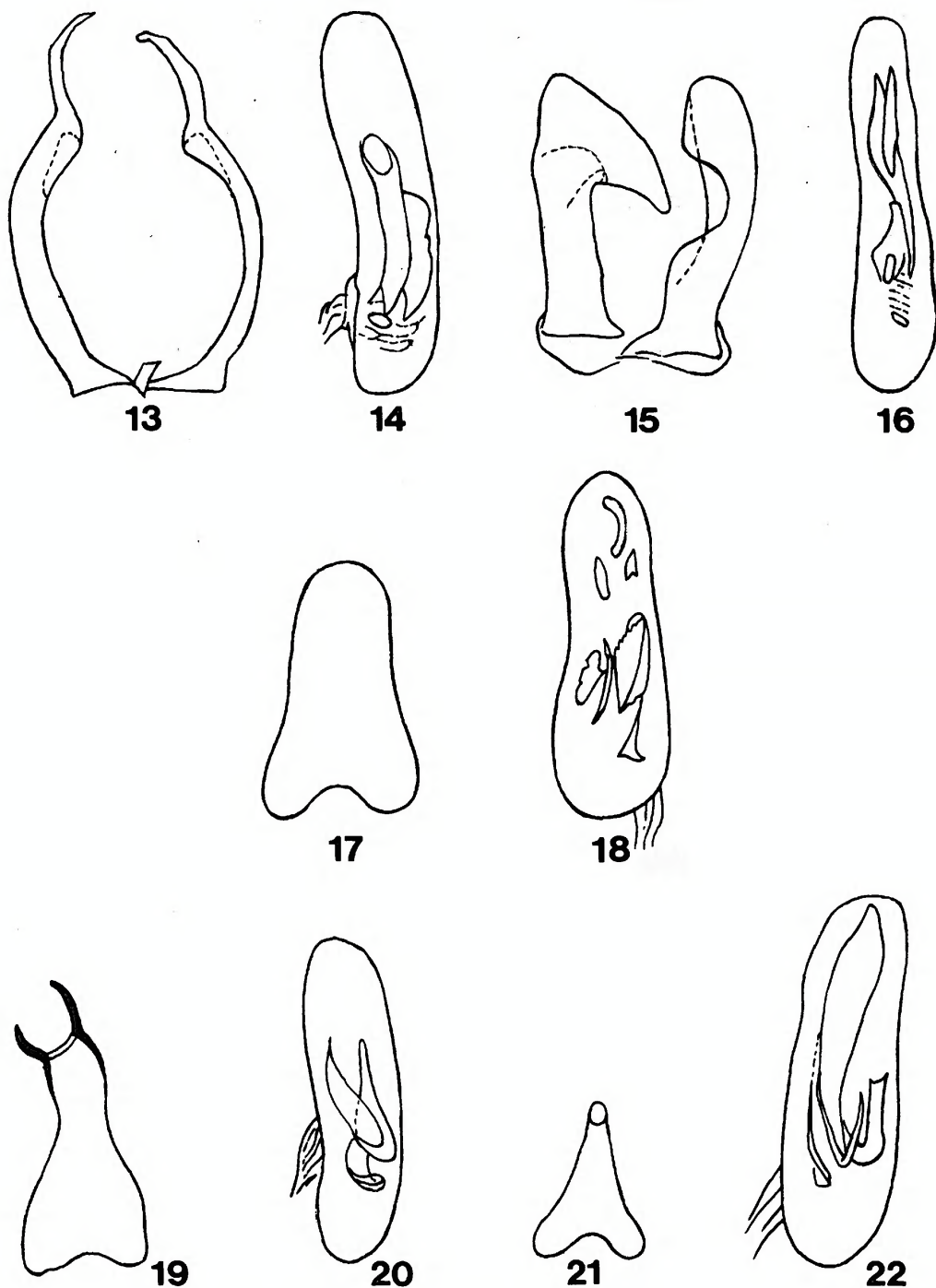
Eupithecia herefordaria

Cassino and Swett

Figures 5, 6, 23, 24, 33

Eupithecia herefordaria Cassino and Swett, 1923, p. 18; 1925, p. 56 (specific name spelled three different ways!). McDunnough, 1949, p. 596 (part, not pl. 28, fig. 12, text fig. 7E).

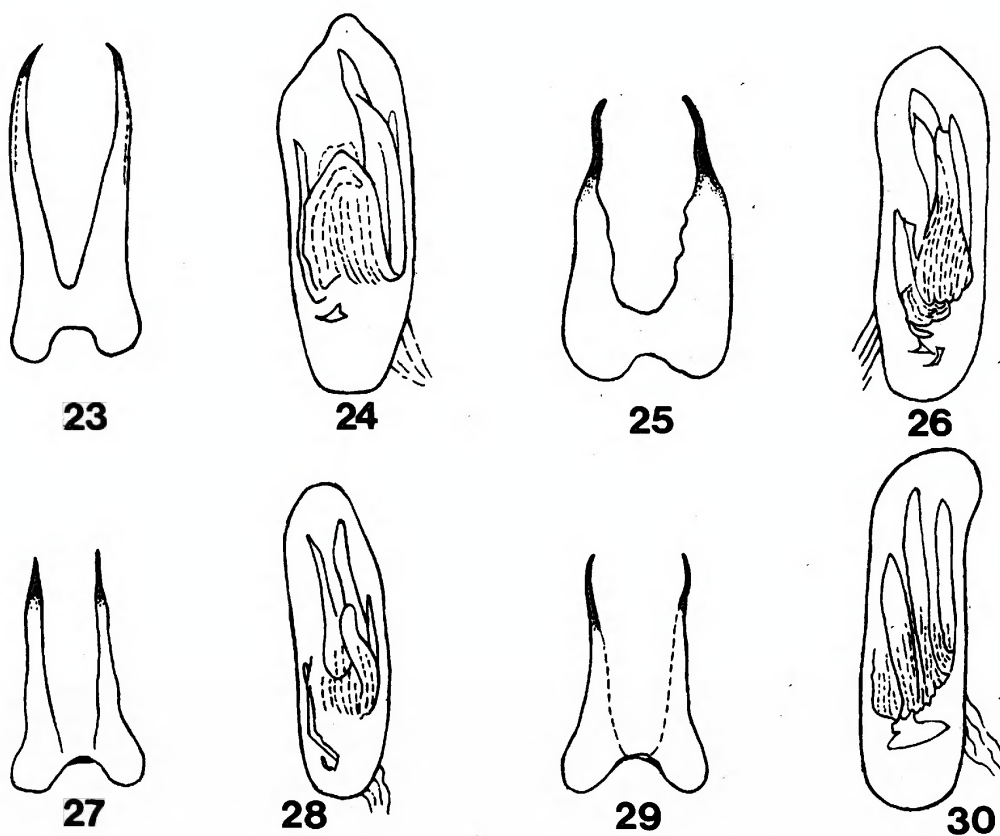
The commonly accepted concept of this species has been in error, due in part to a lack of topotypical material and in part to the similarity of an eastern species. Cassino and Swett described *herefordaria* from a holotype male (see fig. 5), with its genitalia on slide 2420; this is MCZ type 16783, and both the specimen and slide are before me. Surprisingly, there is a "paratype" of this species in the



FIGS. 13-22. Ventral plates and aedeagi of *Eupithecia*. 13, 14. *E. peckorum* Heitzman and Enns. 15, 16. *E. miserulata miserulata* Grote. 17, 18. *E. swettii* Grossbeck. 19, 20. *E. vicksburgi*, new species, paratype. 21, 22. *E. broui*, new species, holotype.

MCZ, although this female was never mentioned in the original description. The orig-

inal description is fairly good, considering the slightly worn condition of the type, and the



FIGS. 23–30. Ventral plates and aedeagi of *Eupithecia*. 23, 24. *E. herefordaria* Cassino and Swett. 25, 26. *E. matheri*, new species, paratype. 27, 28. *E. exudata* Pearsall. 29, 30. *E. jejuna* McDunnough.

genitalic slide is very good, although the ventral plate, mentioned in the description, is missing.

In the AMNH is a series of 11 males and one female from Carr Canyon, elevation 5000 ft, Huachuca Mountains, Cochise Co., Arizona, March 8, 12, 1977 (R. Wielgus), two females from the Southwestern Research Station of the AMNH, elevation 5000 ft, Portal, Cochise Co., Arizona, March 31, 1956, April 10, 1956 (Cazier and Ordway), and one female from Sierra Vista, Cochise Co., Arizona, March 14, 1967 (R. F. Sternitzky). Dissections of both sexes of these specimens showed that they were not what McDunnough (1949) had described and illustrated as *herefordaria*, although the two species are very similar to each other structurally and in size and color. This led me to a study of the type of *herefordaria*, and the above Arizona specimens match it without question. The material from Carr Canyon and

Sierra Vista was captured within a relatively few miles of Hereford, the type locality, and so can be considered almost topotypical.

True *herefordaria* is a gray species with very long, flattened palpi that extend beyond the eyes a distance slightly greater than the diameter of the eyes (males) to 1.5 times its diameter (females). The male antennae are weakly laterally flattened, slightly serrate, the segments are twice as long as wide (viewed from above), and are weakly trifasciate, with the setae being about one-half the length of the segments. The female antennae are very shortly ciliate.

The forewings are elongated, with a pointed apex; the upper surface is an almost unicolorous gray, as the maculation is but faintly represented, with the discal dots and partial t. p. line or band being present. The hind wings are paler than the forewings, but darkened along the anal margin; the maculation is usually absent, although a small discal dot

may be present in some specimens. The under surface is similar to the upper surface but somewhat paler; the maculation may be slightly more pronounced. The length of the forewings ranges from 9.0 to 10.5 mm.

The ventral plate (fig. 23) consists of two tapering, weakly sclerotized arms, basally with from 1.5 to 2.0 mm before separating, the distal one-third of each arm becoming more heavily sclerotized and tubular, with each pointed apex curving mediodorsally. The male genitalia have a slender uncus with a smaller second posteroventral apical point; the anellus is broadly elliptical, with the flattened curved posterior arms ventrally overlaying the anellus for a short distance; the valves are broad and somewhat triangular; the aedeagus (fig. 24) is broad (0.4 mm wide) and faintly tapering anteriorly; the vesica has a small anterior bent piece, a broad median ventral ridged piece and a short rounded piece on the left, with two elongate rods more than one-half the length of the aedeagus, the left rod being longer than the right one. The female genitalia have the quadrate posterior portion of the bursa copulatrix (fig. 33) smoothly sclerotized, concave, with the edges appearing to curve partially over the ventral surface, with a smooth anteroventral swelling on the left side, the smooth area on the ventral surface extending anteriorly to the right, tapering, and from its apex the ductus seminalis arises; the swollen anterior portion is asymmetrical, stellate except for the anterodistal area on the left side, with a deep indentation between the anterior portion and the quadrate area on the right, and with an extension of the stellate area dorsally across part of the smoothly sclerotized quadrate area.

The early stages and food plant are unknown.

This species is known to occur only in Cochise County, southeastern Arizona.

What may be called the *herefordaria* group of species includes several others from the southwestern United States, from west Texas to California, and, in the eastern United States, *exudata* Pearsall, *jejunata* McDunnough, and a new species described below. The included species are recognized by the similar types of ventral plates, the armature of the vesica, and by the general configuration of the female genitalia. Many of

the included species apparently fly early in the year, and have more or less elongate forewings. Perhaps as a result of their early flight period, many of the species are poorly represented in collections and hence have been little studied and understood.

For the purpose of the present paper, I confine my remarks to the three eastern representatives of the group, now that *herefordaria* itself has been redescribed. Of these, only *exudata* is not known to occur in the southeast; it was described from Pennsylvania and I have taken it in Virginia. All of these few specimens were caught in April. Compared with *herefordaria*, this species has much shorter palpi, extending but one-half the diameter of the eye in front of the eyes in the male (the female is unknown to me). The wings are shorter and broader than those of *herefordaria*, and the upper surface is more contrastingly marked (fig. 8). The arms of the ventral plate (fig. 27) are more slender, extend all the way to the base of the segment, and only the apical one-fifth is sclerotized. In the male genitalia, the anellus is broadly elliptical, with the anterior portion more conspicuously covered with flatly rounded, lightly sclerotized tissue, and with a definite constricted area that separates the smaller, curved posterior arms from the anellus; the aedeagus (fig. 28) is narrower (0.3 mm) and has parallel sides; the vesica has three elongate, striated spines, the most anterior of which is the shortest, is slightly wider than the other two, and has a broad, recurved, striated base, whereas the other two longer spines apparently have rounded bases.

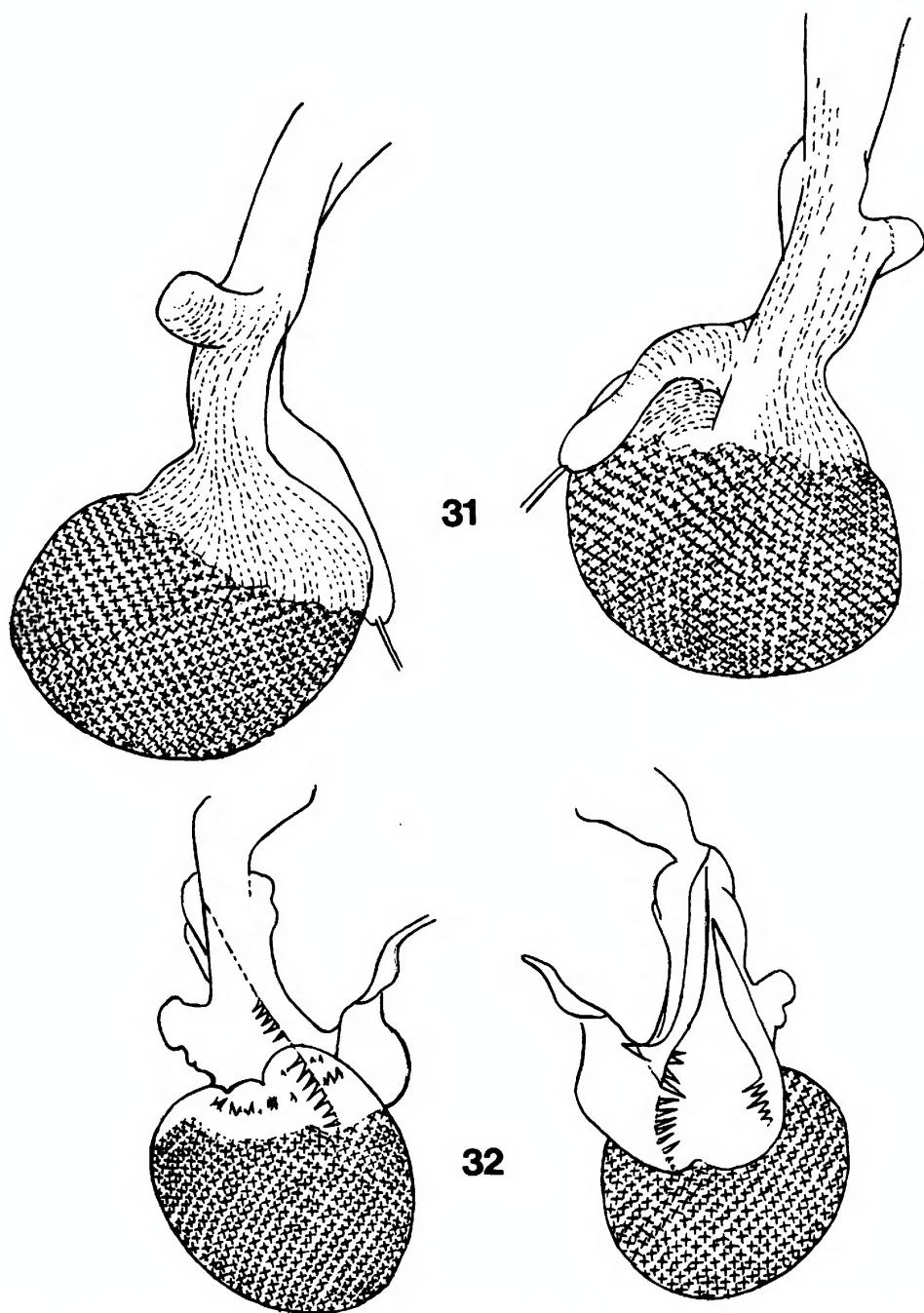
***Eupithecia matheri*, new species**

Figures 7, 25, 26, 34

Eupithecia herefordaria (misidentification): McDunnough, 1938b, p. 236 (Jeff Davis Co., Texas); 1949, p. 596, pl. 28, fig. 12 (adult), text fig. 7E (valve, aedeagus, ventral plate, ovipositor lobes, bursa copulatrix) (bibliography, synonymy, description, in part). McFarland, "1966" [1968], p. 16 (northeastern Kansas). Heitzman and Enns, "1978" [1979], p. 59, fig. 36 (adult); "1978" [1980], p. 162, figs. 26–28 (ventral plate, aedeagus, male genitalia).

Eupithecia exudata herefordaria (misidentification): McDunnough, 1941, p. 189.

DIAGNOSIS: This species has elongate,



FIGS. 31, 32. Bursae copulatrices of *Eupithecia*, ventral (left) and dorsal (right) views. 31. *E. peckorum* Heitzman and Enns. 32. *E. miserulata miserulata* Grote.

pointed forewings, the upper surface of which has obscure maculation; the palpi extend beyond the front of the eye by a distance equal to the diameter of the eye (males) or slightly

more (females); the ventral plate consists of flat, tapering arms that do not reach the base of the segment and whose apices are shortly sclerotized, pointed and incurved; the ob-

vious part of the vesica is three or four elongate, striate rods, one of which is almost twice as wide as the others; the female genitalia have the smoothly sclerotized portion of the bursa copulatrix with a number of parallel striations on the anterodorsal surface.

ADULTS: Head with palpi extending beyond front of eye by distance equal to diameter of eye (males) or slightly more (females); antennae with segments twice as long as wide, males bifasciculate below, ciliae equal in length to length of segments, females very shortly ciliate. Abdomen without basal band.

Upper Surface of Wings: Wings elongate, with attenuate apex to forewing; forewings gray with faint brown tinge, maculation obscure, t. a. and t. p. lines weakly indicated, median area slightly darkened, discal dot present, and slender terminal line obsolescent. Hind wings paler than forewings, darkened along anal margin, with or without small discal dots and partial extra discal lines.

Under Surface of Wings: Gray or faintly brownish gray, with obsolescent maculation; forewings with discal dot obsolescent to present, t. p. band variably represented; hind wings similar or with slightly stronger maculation.

Length of Forewings: Holotype and allotype, 9.0 mm; males and females, 8.5 to 10.0 mm.

MALE GENITALIA: Ventral plate (fig. 25) with flat, tapering arms not attaining base of segment by 0.1 mm, distal one-third heavily sclerotized, apices becoming rodlike and curving dorsally. Male genitalia with bifid uncus, dorsal hook more slender than ventral one; anellus broadly elliptical, with anterior portion overlain with flatly rounded, membranous tissue, posterior margin with pair of sclerotized points at outer basal portion of flattened, curved posterior arms; valves broad, tapering to apex; aedeagus (fig. 26) broad, 0.4 mm wide, with parallel sides; vesica with three or four elongate striate rods, dorsal one twice as wide as others, a smoothly sclerotized, shorter concave lateral piece, a small, twisted anterior piece, and nebulous striated area between lateral piece and rods.

FEMALE GENITALIA: Bursa copulatrix (fig. 34) with posterior area almost twice as long as wide, smoothly sclerotized, concave, with

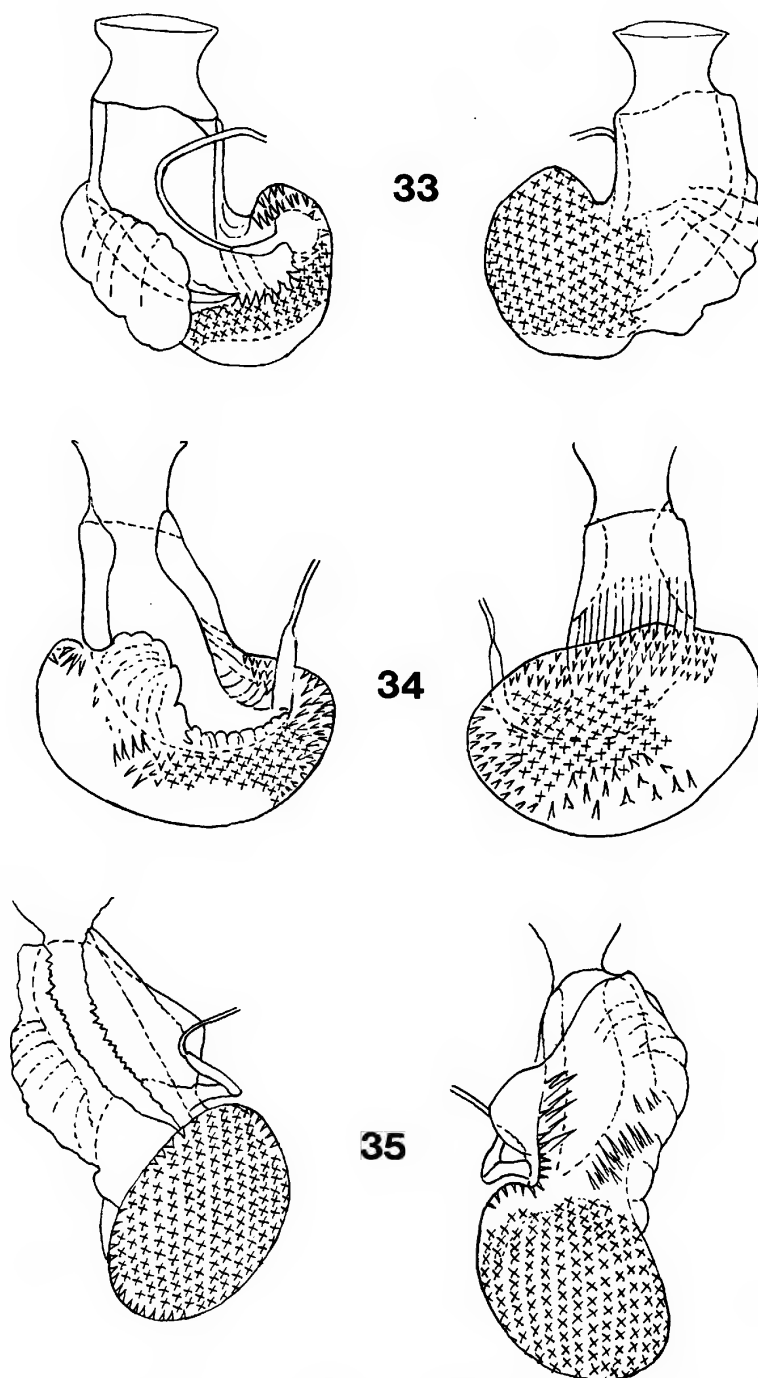
lateral margins apparently recurving ventrally, dorsal surface with anterior one-half longitudinally striate, ventral surface with smooth area extending anteriorly to right, tapering, from its apex ductus seminalis arises, swollen anterior portion stellate except for anterodistal area on left side, with shallow indentation between anterior portion and smoothly sclerotized area on right.

EARLY STAGES: Unknown.

FOOD PLANT: Unknown.

TYPES: Holotype, male, Vicksburg, Warren Co., Mississippi, February 23, 1983 (B. Mather); allotype, female, same locality and collector, March 14, 1983. The genitalia of the holotype are mounted on slide FHR 19364A, and one antenna and set of legs on 19364B; the genitalia of the allotype are on slide FHR 19319A, with one antenna and set of legs on 19319B. **Paratypes:** **MISSISSIPPI:** same locality and collector as holotype, February 24, 1972, one male; February 18, 1975, one male; February 18–March 24, 1977, five males, five females; March 14–30, 1978, three males, six females; March 28, 29, 1979, four females; February 29–March 10, 1980, two males, 18 females; February 27–March 6, 1981, seven males, 16 females; January 27–March 18, 1982, eight males, 12 females; February 16–March 14, 1983, nine males, seven females; February 24–March 23, 1984, seven males, 71 females. **Bovina, Warren Co. (B. Mather),** March 13–21, 1972, one male, one female; March 1–12, 1973, one male, one female; February 18–21, 1975, one male, three females; February 12–March 3, 1976, five males, nine females; February 23, 1977, one female; March 15, 1978, two females; March 2, 1979, one male. **Clinton, Hinds Co.,** March 15, 1967 (B. Mather), one female. **LOUISIANA:** 4.2 mi NE Abita Springs, St. Tammany Parish, February 24–March 7, 1983 (V. A. Brou), two males, three females. **Weyanoke, West Feliciana Parish (V. A. Brou),** April 9, 1978, one female; March 31, 1979, two females; February 27–March 11, 1981, two males, one female; February 19–March 19, 1982, four males, five females. **Fluker, Tangipahoa Parish (V. A. Brou),** March 30, 1979, one female; March 8, 1980, two males, three females.

The holotype and allotype are in the col-



FIGS. 33–35. Bursae copulatrices of *Eupithecia*, ventral (left) and dorsal (right) views. 33. *E. herfordaria* Cassino and Swett. 34. *E. matheri*, new species. 35. *E. jejuna* McDunnough.

lection of the AMNH; paratypes are in the collections of that institution, of Bryant Mather, and of Vernon Brou.

DISTRIBUTION: Specimens are before me from Connecticut, New York, New Jersey, Pennsylvania, Virginia, North Carolina, Mis-

Mississippi, Louisiana, and Texas; it has been reported from Kansas (McFarland, "1966" [1968]). McDunnough (1938b) reported this species from Jeff Davis Co., western Texas; I have not studied his material but there is one female before me from that county and it certainly looks like *matheri*.

FLIGHT PERIOD: From late January into early April.

REMARKS: I have examined 100 males and 227 females; of these, 62 males and 155 females are in the type series from Mississippi and Louisiana. Plus 20 genitalic dissections, of which eight are males and 12 females; five of the former and two of the latter are from specimens in the type series.

This species, with its elongated, pointed forewings is likely to be confused with *swettii* Grossbeck; both species often fly at the same localities and at the same time. The present species has the upper surface of the wings a more uniform pale gray and has obsolescent maculation, whereas *swettii* has browner wings and a more clearly defined pattern and larger discal spot on the forewings. The palpi of *matheri* tend to be a unicolorous gray, with but relatively few pale scales ventrally; *swettii* has darker brown palpi, usually with a well-defined white area at the lower edge of the basal segment and with some pale scaling sometimes present ventrally on the second segment. Any doubts as to identifications can easily be settled by a study of the genitalia.

ETYMOLOGY: I take great pleasure in naming this species after Bryant Mather, the indefatigable collector of Mississippi Lepidoptera, including much of the type series of this species.

Eupithecia jejunata McDunnough

Figures 9, 29, 30, 35

Eupithecia jejunata McDunnough, 1949, p. 574, pl. 27, fig. 15 (holotype female), text fig. 5A (female genitalia, drawn from holotype). Rindge, 1956, p. 3, figs. 1, 2 (aedeagus, ventral plate); 1963, p. 4. Heitzman and Enns, "1978" [1979], p. 59, fig. 32 (adult); "1978" [1980], p. 162, figs. 38–40 (male genitalia, ventral plate).

This small gray species has short palpi that extend beyond the eye one-half (male) to three-fourths (female) the diameter of the eye. The male antennae are weakly serrate, the

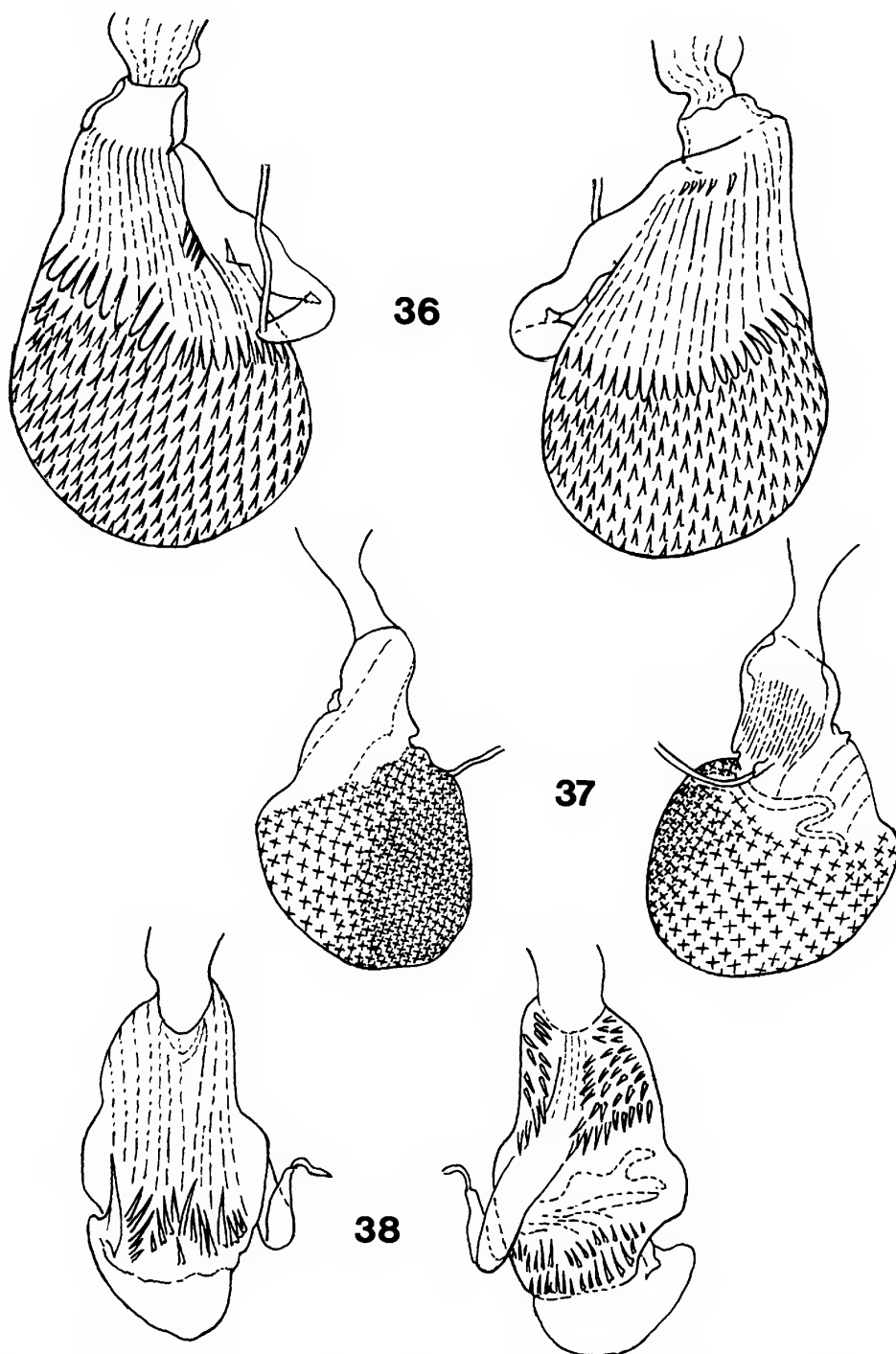
segments only slightly longer than wide, and thickly ciliate on the lower surface, with the longest cilia being almost as long as the individual segments. The female antennae are similar to those of the male but have much shorter cilia.

The upper surface of the short, broad forewings is gray and has an indistinct pattern, with a dark discal spot and a straight t. p. line usually present; the hind wings are concolorous with, or slightly paler than, the forewings, and the pattern is basically similar to that of the anterior pair of wings. The under surface is a paler gray, all wings have a small discal dot, and the forewings have a pale subterminal band. The length of the forewings is 7.5 to 8.5 mm in the series from Mississippi.

The ventral plate (fig. 29) consists of two tapering arms, connected at their bases by a slender rod, with their basal portion flattened and with slightly irregular edges, the terminal one-fourth becoming more heavily sclerotized and tubular, and each arm having a sharply pointed apex. The male genitalia have the uncus laterally flattened and with two points; the anellus is flatly elliptical with a definite neck connecting the posterior arms; the valves are relatively short and broad; the aedeagus (fig. 30) is short and wide (0.3 mm); the vesica has two small sclerotized basal pieces and three elongate, longitudinally striated rods of different lengths, extending seven-tenths the length of the aedeagus. The female genitalia have the bursa copulatrix (fig. 35) with an elongate posterior portion, lightly sclerotized, somewhat irregular in shape, with internal spinose bands on opposite sides, the anterior portion is swollen, diagonal, and stellate, with the ductus seminalis arising on the right side near the junction of the posterior and anterior portions of the bursa copulatrix. The ventral arms of each apophysis anteriores is continued as a sharply defined sclerotized band across most of the ventral surface of segment 8.

The early stages and food plant are unknown.

McDunnough described this species from two females, the holotype being from Georgetown, Williamsburg Co., eastern Texas, and the paratype from Georgia (Hy. Edwards collection). I described the male and



FIGS. 36–38. Bursae copulatricae of *Eupithecia*, ventral (left) and dorsal (right) views. 36. *E. swettii* Grossbeck. 37. *E. vicksburgi*, new species, allotype. 38. *E. broui*, new species, allotype.

illustrated the aedeagus and ventral plate (1956, p. 3, figs. 1, 2) from specimens taken

in Sarasota Co., Florida; later (1963, p. 4) I gave additional Florida and Texas records,

plus adding Mississippi to the known distribution. Subsequent collecting shows that *jejunata* is widespread throughout the southeast, as it extends from eastern Texas, north into Arkansas and Missouri, east through Louisiana and Mississippi and Florida, and north to coastal North Carolina. The moths are on the wing from February into mid-May (Missouri), with the majority of southern specimens bearing February and March dates. There can be a partial second generation, as I have before me two males from Mississippi: one is labeled State College, Oktibbeha Co., August 16, 1976 (C. Bryson), the other Handsboro, Harrison Co., September 25, 1966 (B. Mather).

In the south, this species can be recognized by its small size, short palpi, and relatively broad wings; there are no other species with this combination of characters. In the eastern United States *jejunata* may be confused with *exudata* Pearsall; the latter species has been discussed above.

I have studied 321 specimens (166 males, 155 females) of *jejunata*; the great majority are from Mississippi (111 males, 104 females) and Louisiana (36 of each sex), plus 19 genitalic dissections (11 males, eight females).

Eupithecia swettii Grossbeck

Figures 10, 17, 18, 36

Eupithecia swettii Grossbeck, 1907, p. 346. McDunnough, 1949, p. 614, pl. 29, figs. 2, 3 (adults), text fig. 9E (valve, aedeagus, ventral plate, bursa copulatrix) (full biography, description). Rindge, 1963, p. 8.

Eupithecia swetti [sic]: Barnes and McDunnough, 1917, p. 110. McDunnough, 1938a, p. 149. Forbes, 1948, p. 166. McFarland, "1966" [1968], p. 16. Heitzman and Enns, "1978" [1979], p. 59; "1978" [1980], p. 162, figs. 29–31 (aedeagus, ventral plate, male genitalia).

This larger, brownish species has moderately long palpi that in the males extend beyond the front of the eyes by a distance about equal to the diameter of the eye and in the females are only slightly longer; the palpi have some white scaling along the ventral edge. The antennal segments are twice as long as wide and are somewhat laterally compressed; the males are ciliate below, in poorly defined groups of three or four, with the length of the

slender setae being about equal to the width of the segments, whereas the females are very shortly ciliate.

The upper surface of the forewings is a light fawn brown shading to grayish brown, with an indistinct pattern; the discal dot and the t. p. line or shade are usually present. The hind wings are slightly paler than the forewings, and have a minute discal dot and may or may not have an extradiscal line or band. The under surface of all wings is pale gray with an obsolescent pattern, as small discal dots are present, and the outer cross lines may or may not be represented. The length of the forewings is from 8.5 to 10.5 mm in Mississippi specimens.

The ventral plate (fig. 17) is large, broad, slightly tapered posteriorly, and has a truncate apex. The male genitalia have a tapering uncus, with a second, smaller posterodorsal point; the rather small anellus has a long neck connecting with the more heavily sclerotized, rounded, rodlike posterior arms; the valves are moderately triangular; the aedeagus (fig. 18) is widest in the anterior portion; the vesica is armed with several short sclerotized pieces. The female genitalia have a large bursa copulatrix (fig. 36) with a short flattened posterior necklike area, the right side extends into a shoulder from which the ductus seminalis arises, the shoulder has a short row of inwardly projecting spines dorsally and ventrally, and the smoothly sclerotized, longitudinally striate posterior end evenly swells into a large rounded spined area, the spines extending farther posteriorly on the left side than on the right, and with the spines at the junction of the spinose and smoothly sclerotized areas being noticeably longer than the other spines.

The early stages and food plant are apparently unknown although Salkeld (1983, p. 250, fig. 123a–d) described and illustrated the egg.

The species is found in eastern North America, from Quebec and Massachusetts in the north, to North Carolina in the southeast, and through Missouri and Kansas to Mississippi (Rindge, 1963). It has been taken in eastern Texas by Blanchard and Knudson (Knudson, in letter). Southern specimens have been captured from January into April, with some May and July records in the north.

This species can be confused with the adults of *matheri*; see the comments under Remarks for the latter species (above) for means of distinguishing the two.

There are 124 specimens (74 males, 50 females) of *swettii* before me; of these 64 (38 males, 26 females) are from Mississippi and 17 (13 males, four females) are from Louisiana. In addition, 29 genitalic dissections (13 males, 16 females) have been studied.

***Eupithecia vicksburgi*, new species**

Figures 11, 19, 20, 37

DIAGNOSIS: This species has broad forewings, the upper surface of which has rather indistinct maculation except for the prominent discal spot; the palpi extend beyond the front of the eyes by four-fifths the diameter of the eye (males) or slightly more (females); the ventral plate has a broad base, is narrowed at two-thirds its length, and the apical portion is slender, swollen and bent to the left, terminating in two prominent spines, the right one of which is the longer; the obvious part of the vesica is two sclerotized rods of about equal size that are enlarged basally; the female genitalia have an elliptical bursa copulatrix, the anterior three-fifths being finely stellate, with the ductus seminalis arising from the dorsal surface.

ADULTS: Head with palpi extending beyond front of eyes by four-fifths diameter of eyes (males) or by slightly more than diameter of eye (females), basal and second segments with narrow white band of scales ventrally; antennae with segments twice as long as wide, males bifasciculate, ciliae tending to extend laterally, in length about equal to length of segments, females very shortly ciliate. Abdomen without basal band.

Upper Surface of Wings: Forewings broad, with rounded apex; gray with numerous brown scales; maculation obscure, with faint lines, discal spot black, prominent, subterminal band often present, subterminal line variably represented, usually only by white spot above outer angle. Hind wings concolorous with forewings, small discal spot usually present, with faint lines as on forewings.

Under Surface of Wings: Forewings gray, with grayish brown scaling, discal spot black, veins in outer part of wings with brown scaling, indicating t. p. and s. t. lines; hind wings

paler than forewings, with discal spot and two outer cross lines indicated by darkened veins.

Length of Forewings: Holotype, 9.0 mm, allotype, 10.5 mm. Paratypes: spring generation, males, 8.5 to 9.5 mm, females, 9.5 to 10.5 mm; fall generation, males, 7.5 to 8.0 mm (no females known).

MALE GENITALIA: Ventral plate (fig. 19) with broad base, narrowed medially with lateral margins becoming sclerotized, apical portion swollen and curved to left, terminating in two prominent spines, right one longer and more curved than one on left. Male genitalia with bifid uncus, dorsal hook more slender than ventral one; anellus narrowly elliptical, posteriorly with large neck, equal to two-fifths width of anellus, tapered outwardly to curved posterior arms; valves broad, rounded apically; aedeagus (fig. 20) with parallel sides; vesica with two median sclerotized rods enlarged basally, of approximately equal size, slightly less than one-half length of aedeagus, and with small sclerotized basal piece.

FEMALE GENITALIA: Bursa copulatrix (fig. 37) elliptical, with anterior three-fifths finely stellate, posterior end membranous except for lightly sclerotized, dentate, dorsal area; ductus seminalis arising dorsally from anterior end of lightly sclerotized dorsal area. Apophyses posteriores with posterior end broadly bifurcate, ventral arms extending almost to midline of segment and being broadly flattened apically.

EARLY STAGES: Unknown.

FOOD PLANT: Unknown.

TYPES: Holotype, male, Vicksburg, Warren Co., Mississippi, March 26, 1981 (B. Mather); allotype, female, same data and collector, March 18, 1982. The genitalia of the holotype are mounted on slide FHR 19040, and of the allotype on FHR 19285. Paratypes, all from Mississippi: Same data and collector as holotype, April 14, 1972, one female; September 25, 1972, one male; March 11, 1974, one male; March 21, 24, 1977, three males; April 6, 1978, one male, two females; October 13, 1978, one male; March 11, 28, 1980, one male, one female; October 5, 1981, one male. Bovina, Warren Co., March 6, 1975 (B. Mather), one male. Mississippi State University, Oktibbeha Co., April 3, 1975 (C. Bryson), one female.

The holotype and allotype are in the collection of the AMNH; paratypes are in the collections of that institution and of Bryant Mather.

DISTRIBUTION: This species is known only from the type series from Mississippi.

FLIGHT PERIOD: March and April; September and October.

REMARKS: Seventeen specimens (11 males, six females) and 11 genitalic dissections (seven males, four females) have been studied.

This species is very similar to *fletcherata* Taylor; for a description and illustrations of the latter species, see McDunnough, 1949, p. 579, pl. 27, figs. 22–24 (adults), text fig. 5E (male and female genitalia). The new species can be differentiated from *fletcherata* by the ventral plate of the male being less constricted distally and having the posterior portion more swollen and with the apical spines more convergent, by the narrower neck of the anellus, and by the spines in the vesica being of about the same size, instead of one being noticeably longer as in *fletcherata*. In the female genitalia of *vicksburgi* the stellate anterior portion of the bursa copulatrix has a much more even posterior border, whereas in *fletcherata* it is irregular, with a posteriorly directed lobe on the dorsal surface; in the present species the ductus seminalis arises dorsally, while in *fletcherata* it comes off ventrally from the right side.

Eupithecia fletcherata occurs in northeastern North America, from Quebec, Ontario and Michigan, south in the mountains to North Carolina; *vicksburgi* is known only from Mississippi. Heitzman and Enns ("1978" [1979], p. 59; "1978" [1980], p. 162, figs. 32–34 [male genitalia]) report *fletcherata* from Missouri; I have not examined any material from that state, and am unable to tell from their figures which species is represented.

ETYMOLOGY: The specific name is a noun in the genitive case, based on the type locality.

***Eupithecia broui*, new species**

Figures 12, 21, 22, 38

DIAGNOSIS: This species has broad forewings, the upper surface of which has clearly marked cross lines and discal spots; the palpi

extend beyond the front of the eye by about nine-tenths the diameter of the eye (males) or the same to a distance equal to the diameter of the eye (females); the ventral plate is weakly sclerotized, triangular but with concave sides, and has two scarcely differentiated short rods at the apex; the vesica has a very large, heavily sclerotized rod with a recurved base and a smaller basal piece; the female genitalia have an approximately rectangular bursa copulatrix, the anterior portion having numerous long posteriorly directed spines, and the posterior portion a larger number of shorter, dorsal spines, with the ductus seminalis arising dorsolaterally on the right side.

ADULTS: Head with palpi extending beyond front of eye by about nine-tenths diameter of eye (males and females) or a distance equal to diameter of eye (females), basal and second segments with very narrow white band of scales ventrally; antennae with segments slightly longer than wide, males distinctly bifasciculate, ciliae as long as their segments, females very shortly ciliate. Abdomen with basal segment tending to be slightly paler than other segments.

Upper Surface of Wings: Forewings broad, gray, with numerous grayish brown scales; numerous, very slender, dark cross lines present, with t. a. line angulate below costa, incomplete median line going to short discal spot, t. p. line curved, followed by pale shade line, and with partial whitish s. t. line. Hind wings slightly paler than forewings, maculation reduced but indicated distad of small discal dots.

Under Surface of Wings: Forewings paler gray than upper surface, with elongate discal dash, weakly represented t. p. line and shade, terminal portion of wings darker gray; hind wings paler than forewings, with maculation similar to upper surface.

Length of Forewings: Holotype, 9.7 mm; allotype, 10.0 mm; paratypes, males, 9.5 to 10.5 mm, females, 9.0 to 10.0 mm.

MALE GENITALIA: Ventral plate (fig. 21) weakly sclerotized, triangular, sides slightly concave, apex membranous with a scarcely differentiated short rod on each side. Male genitalia with dorsally swollen uncus, apex with two equal-sized points; anellus broad, posterior margin slanting to prominent neck, then abruptly changing to curved posterior

arms; valves triangular, sacculus narrowly swollen, terminating in short projecting point beyond middle of valve; aedeagus (fig. 22) widened anteriorly; vesica with single, heavily sclerotized rod three-fourths length of aedeagus, flattened posteriorly, anteriorly narrowed and recurved, with second, smaller, less heavily sclerotized U-shaped rod and slightly curved thinner piece, both on left side.

FEMALE GENITALIA: Bursa copulatrix (fig. 38) more or less rectangular, posteriorly with dorsal surface having numerous, short, inwardly projecting spines, ventral surface smoothly sclerotized with longitudinal striations, medially membranous, anterior section with numerous, long, posteriorly projecting spines, and with anterior end narrowly membranous; ductus seminalis arising dorsolaterally on right side near middle of bursa copulatrix.

EARLY STAGES: Unknown.

FOOD PLANT: Unknown.

TYPES: Holotype, male, Weyanoke, West Feliciana Parish, Louisiana, February 27, 1981 (V. A. Brou); allotype, female, same data and collector, February 19, 1982. The genitalia of the holotype are mounted on slide FHR 19392, and of the allotype on FHR 19353. Paratypes: LOUISIANA: Same data and collector as holotype, April 9, 1978, one female; March 11, 1982, one female; February 19, 1982, one male, five females. Fluker, Tangipahoa Parish, May 8, 1980 (V. A. Brou), one male, two females. 4.2 mi NE Abita Springs, St. Tammany Parish, March 18, 1983 (V. A. Brou), one female. MISSISSIPPI: Vicksburg, Warren Co., March 2, 1977 (B. Mather), one male. Pricedale, Pike Co., March 20, 1960 (B. Mather), one male. Jackson, Hinds Co., March 14, 1964 (B. Mather), one female.

The holotype and allotype are in the collection of the AMNH; paratypes are in the collections of that institution and of Vernon A. Brou.

DISTRIBUTION: Louisiana, Mississippi, and coastal North Carolina. The two males and three females (in AMNH) from the last state are excluded from the type series.

FLIGHT PERIOD: February, March, and April.

REMARKS: Twenty-two specimens (seven males, 15 females) and 10 genitalic dissec-

tions (four males, six females) have been studied.

Based on the male genitalia and ventral plate, this species appears to be most closely related to *zelmira* Swett and Cassino and *vitreotata* Cassino; the last two species were described and illustrated by McDunnough (1949, pp. 643, 644, pl. 30, figs. 20, 21, text fig. 12F, G). The present species differs from the other two by having a swollen uncus with two equal-sized points, a smaller hook at the end of the cucullus, and a broadened apex to the large spine in the vesica; in *zelmira* and *vitreotata* the uncus is slender, elongate, and the dorsal point is much smaller than the ventral one, the cucullar hook is prominent, and the rod in the vesica terminates in a series of lateral prongs. The ventral plates of all three species appear quite similar to each other, although the one of *broui* appears to be more slender. The female genitalia of the present species are unlike any described from North America.

Eupithecia zelmira is known from California and Oregon, *vitreotata* from Arizona, and *broui* from the southeastern United States.

ETYMOLOGY: I take pleasure in naming this species after Vernon A. Brou, the indefatigable collector of Louisiana Lepidoptera, including the majority of specimens in the type series of this species.

LITERATURE CITED

- Barnes, Wm., and J. McDunnough
1917. Check list of the Lepidoptera of boreal America. Decatur, Illinois, the Herald Press, vii + 392 pp.
- Cassino, Samuel E., and Louis W. Swett
1923. New geometrids. *The Lepidopterist*, vol. 4, pp. 18-24.
1925. Corrections. *Ibid.*, vol. 4, p. 56.
- Forbes, William T. M.
1948. Lepidoptera of New York and neighboring states. Part II. Mem. Cornell Univ. Agr. Exp. Sta., no. 274, 263 pp., 255 figs.
- Grossbeck, John A.
1907. Notes on Eupithecia, with descriptions of new species. *Ent. News*, vol. 18, pp. 342-349.
- Grote, Aug. R.
1863. Additions to the catalogue of U.S. Lepidoptera, no. 3. *Proc. Ent. Soc. Philadelphia*, vol. 2, pp. 30-33, pl. 2.

- Heitzman, Roger L.
1973. An annotated checklist of the Missouri Geometridae (Lepidoptera). Jour. Res. Lepidoptera, vol. 12, pp. 169–179.
- Heitzman, Roger L., and Wilbur R. Enns
1977. Descriptions of a new species of *Eupithecia* and the male of *E. cocoata* Pear-sall (Geometridae). Jour. Res. Lepidop-tera, vol. 16, pp. 75–82, pls. I, II.
“1978” [1979]. Annotated list and keys to the geometrid subfamily Larentiinae (Lep-idoptera: Geometridae) of Missouri. Trans. Missouri Acad. Sci., vol. 12, pp. 47–73, figs. 1–46.
“1978” [1980]. Male genitalic illustrations and notes on the Larentiinae of Missouri. Jour. Res. Lepidoptera, vol. 17, pp. 145–167, figs. 1–45.
- McDunnough, James H.
1938a. Check list of the Lepidoptera of Canada and the United States. Part I. Macro-lepidoptera. Mem. So. California Acad. Sci., vol. 1, pp. 1–275.
1938b. Some apparently new Texas Eupithe-cias. Canadian Ent., vol. 70, pp. 236–242.
1941. Eupithecia notes, II. *Ibid.*, vol. 73, pp. 189–193.
1949. Revision of the North American species of the genus *Eupithecia* (Lepidoptera, Geometridae). Bull. Amer. Mus. Nat. Hist., vol. 93, pp. 533–728, text figs. 1–20, pls. 26–32.
- McFarland, Noel
“1966” [1968]. Spring moths (Macroheterop-tera) of a natural area in northeastern Kansas. Jour. Res. Lepidoptera, vol. 6, pp. 1–18.
- Peterson, Alvah
1968. Eggs of moths from additional species of Geometridae—Lepidoptera. Florida Ent., vol. 51, pp. 83–94, figs. 1–50.
- Rindge, Frederick H.
1956. Descriptions of and notes on North American Geometridae (Lepidoptera). Amer. Mus. Novitates, no. 1784, pp. 1–19, figs. 1–19.
1963. Notes on and descriptions of North American *Eupithecia* (Lepidoptera, Geometridae). *Ibid.*, no. 2147, pp. 1–23, figs. 1–7.
- Salkeld, E. H.
1983. A catalogue of the eggs of some Cana-dian Geometridae (Lepidoptera), with comments. Mem. Ent. Soc. Canada, no. 126, pp. 1–271, figs. 1–131.